Nurse led interventions in hypertension

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Published by Springer International Publishing AG, part of Springer Nature 2018
M. Burnier (ed.), Drug Adherence in Hypertension and Cardiovascular Protection, Updates in Hypertension and Cardiovascular Protection, Chapter 18.
https://doi.org/10.1007/978-3-319-76593-8_18

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Abstract

Hypertension is predominantly detected and managed in primary or community care settings. Nurses are key members of the multidisciplinary primary care team, and are commonly involved in measuring or managing blood pressure. Nurses undertake a range of tasks in hypertension care and many randomised controlled trials of different nurse led interventions have been conducted, providing evidence from different populations. There is good evidence to support better blood pressure outcomes when nurses deliver care face to face, but not remotely. Other important components of these complex interventions appear to be the inclusion of a structured care algorithm, ability to prescribe or altering medications, and maintaining contact at least monthly until blood pressure is controlled to target. There is limited reporting of the costs of interventions and evidence for cost effectiveness of nurse led care compared to usual care is lacking, and there is no clear evidence from longer term follow up of the effect of nurse led interventions on cardiovascular outcomes. The design of programmes for nurse led care in hypertension should take account of the existing evidence and areas of uncertainly. Nurses generally work within teams and future studies of team approaches to hypertension, either including or led by nurses, are needed. Any future studies of nurse led care should include a robust cost effectiveness analysis.

1.1 Introduction

Raised blood pressure is the main risk factor globally for premature morbidity and mortality.[1] Globally it affected close to one billion adults (26% of the population) in 2000, and is projected to rise to 1.6 billion by 2025.[2] This makes measurement of blood pressure a common reason for consultation in primary care,[3] and rising workload and availability of doctors in primary care is an international concern.[4,5] In English primary care consultation rates for general practitioners rose by 13.6% over the seven years to 2014, whilst rates for nurses rose by only 0.9% during the same period.[6] It is suggested that transfer of some clinical roles from doctors to nurses may help to alleviate the growing workforce crisis, and reviews suggest that appropriately trained nurses can deliver care with the same quality and outcomes as doctors.[7]

A 10 mmHg reduction in systolic blood pressure is estimated to achieve a 41% reduction in stroke and a 22% reduction in coronary heart disease.[8] Whilst blood pressure control is

improving over time the detection and adequate management of high blood pressure remains a challenge.[9] Nurse led care in hypertension is seen as one means of improving implementation of guidelines on blood pressure management.[10,11] Resource limitations also encourage substitution of doctors by nurses and other allied health professionals in the belief that they are less costly,[12] however it continues to be noted that the evidence for this is too limited to support such conclusions.[13]

1.2 Nurse substitution in hypertension

Trials of nurse led care have been appearing since the 1990s,[14-16] however Oakeshott concluded in her 2003 systematic review that there was a lack of robust evidence of effectiveness for nurse led care in hypertension. The 2010 Cochrane update by Glynn et al found evidence of greater reduction of blood pressure with nurse led care but concluded that it required further evaluation,[17] whilst our own focussed systematic review in the same year found some evidence to suggest that outcomes were improved when nurse prescribers were involved in some health care settings. We concluded however, that there was insufficient evidence to support widespread deployment of nurses in the management of hypertension.[18]

In practice there has been shift in hypertension care over the last decade from doctors to nurses and health care assistants, and rising numbers of nurse prescribers are becoming active in hypertension.[19] A multidisciplinary approach can improve control in resistant hypertension, and nurses record lower blood pressures than doctors due to smaller white coat effects,[20-22] thus there seem good reasons to involve nurses in hypertension care. In 2003 Bengtson and Drevenhorn examined and identified the roles of nurses in hypertension care (box 1).[23] In their review they called for further well designed studies to develop nursing care for hypertension, and over 50 randomised controlled trials have been published during the last 15 years. Within our current systematic review of allied health professional led care in hypertension we have reviewed evidence from randomised controlled trials that compare nurse led care with usual care (defined as doctor led care).[24] These are considered with relevant pooled findings in the following sections.

- Team member or team leader
- Measurement of blood pressure – avoiding white coat effect
- Educator in non-pharmacological treatment
- Translator for the physician with a holistic and psychosocial approach
- Promoting lifestyle changes
- Promoting medication adherence
- Titrating blood pressure treatment to target
- Monitoring and maintaining blood pressure treatment

Box 1 – roles of the nurse in hypertension care; after Bengtson and Drevenhorn 2003[23]

1.2.1 Settings for and subjects of interventions

Hypertension is largely diagnosed and managed in primary care, and general or family practice settings have been the usual locations for studies of nurse led interventions.[15,25-47]. Trials have examined nurse led care in a variety of other settings, with evidence from individual randomised controlled trials for lower outcome blood pressures following delivery at home,[48-53] in community centres,[48,54-56] faith groups,[57] community walking groups,[58] and in secondary care clinics for hypertension,[59] diabetes,[60-63] cardiology,[64,65] stroke,[66] or general medicine.[67,68] Greater achievement of study blood pressure targets has also been demonstrated in workplace based interventions.[14,69,70] Target achievement is less often improved within individual trials but pooled analyses confirm evidence of benefit from community settings (Odds ratio (OR) for target achievement with intervention 1.9 (95%CI 1.2 to 3.0); 7 studies, 2820 participants),[14,51,70-74] primary care settings (OR 1.4 (1.1 to 1.6); 13 studies, 11278 participants),[15,25,26,29,34,35,38,41,45,47,65,75,76] and secondary care settings (OR 1.8 (1.3 to 2.5); 11 studies, 3605 participants).[32,36,59-61,63,64,66,67,77,78]

Studies have found evidence of benefit for nurse led interventions from around the globe, thereby including a range of different ethnic populations. Culturally appropriate health education may improve outcomes in ethnic minorities,[79] so some trials have specifically targeted ethnic subgroups regarded as underserved within their respective countries. Improved blood pressure lowering has been demonstrated in African American cohorts,[25,34,35,37,42,48,54,56,67,71], American Hispanic people,[42,67] First Nations American Indian people,[49] Maoris,[80] and South Asians.[75,81]. A substantial number of trials have focussed on control of hypertension with diabetes, suggesting that the findings summarised here can be applied to hypertensives with and without coincident diabetes.[27,28,32,37,38,49,59-63,74-76,78,82,83]

Trials usually seek to recruit subjects with uncontrolled (i.e. above study or protocol target) blood pressures. Only a few studies have restricted recruitment to controlled hypertensives; although some have shown benefit,[27,61] they are outweighed by those that fail to show improved blood pressure outcomes.[34,61,82] Therefore the evidence summarised in this chapter should be viewed as relevant to populations with uncontrolled hypertension.

1.2.2 Features of interventions

1.2.2.1 Mode of review or follow up

Interventions in randomised controlled trials usually include face to face contact with nurses, with or without other modalities. Nurse delivered telephone support for patients without face to face contact appears to be ineffective in delivering lower outcome blood pressures compared to usual care.[25,26,28,34,35,37,52,66,77] Other trials have used telephone support to supplement face to face reviews,[39,45,54,58,71,73,74] but on pooled analysis these show no superiority of systolic blood pressure outcomes compared to interventions based purely on face to face review,[27,29,30,32,33,36,44,49-51,56,59,61,62,64,72,75,78,80,83-85] whilst mean reduction of diastolic pressures compared to usual care are actually greater for face to face interventions without telephone support than with it (-2.1mmHg (-3.0 to -1.2); 22 studies, 7793 participants without telephone support vs. -0.9mmHg (-2.4 to 0.6); 7 studies, 2198 participants; p=0.03). This pattern is also seen for achievement of study blood pressure

targets. These are complex interventions so caution is needed in interpreting these findings, however it may be that combined interventions, by using telephone consultations as a substitute for face to face interim reviews, reducing the frequency of face to face contact (see below). Whatever the cause we can conclude that the routine use of nurse led telephone support for blood pressure lowering is at least ineffective, and possibly counterproductive.

1.2.2.2 Use of a management algorithm

Our previous systematic review in 2010 found that effective nurse led interventions for hypertension require an algorithm to structure care.[18] Taking account of newer studies differences in trial outcomes are no longer seen between studies using or not using an algorithm to structure care, however the quality of reporting of study methods varies.[86] The majority of randomised trials of nurse led care do include an algorithm, and it is likely that, where not stated, other trials also had some structured care component. Structured care has emerged from previous reviews as an important component of effective interventions.[87,88] Where treatment changes are explicit this may help to overcome clinical inertia,[89] therefore a treatment algorithm remains an essential basis for nurse led care in hypertension.

1.2.2.3 adherence/education/support

Physicians recognise the importance of addressing medication non-adherence but less often actually do so.[90] Many interventions include an element of education and lifestyle advice,[56,60,64,67,71,74] or medication adherence support.[48] These elements coupled with regular review are key components of effective long term care, to which the nurse-patient relationship is central.[91] Education and explanation are key to improving medication adherence,[92] which is often found to be higher in clinical trials than in routine care.[93] Education is usually only one element of a complex intervention in trials of nurse led care, so it is not clear from existing trials how important it is that any educational interventions for hypertension are delivered specifically by nurses. Evidence linking medication adherence and blood pressure outcomes is unclear.[94] Existing trials have assessed medication adherence using questionnaires such as the Morisky scale,[95] which are only modestly effective in detecting medication non-adherence in comparison to electronic pill box monitoring.[96,97] Thus specific well designed studies using a robust method of adherence assessment are needed, to clarify whether nurse led educational interventions can be linked to improved medication adherence and better blood pressure outcomes.

1.2.2.4 Home monitoring

Self-monitoring of blood pressure alone,[98] or with electronic transmission of results to physicians can improve blood pressure control,[99,100] but the effect is enhanced when self-monitoring is combined with additional support to the patient.[101] Interventions including nurse monitoring and feedback on home blood pressure readings have proved effective compared to usual care.[48,53] Home blood pressure readings are associated with lower

outcome blood pressures and greater achievement of study targets than clinic measurements.[102] It is not clear whether this difference, in relation to nurse led care, can be wholly accounted for by the interventions themselves or may be confounded by differences due to setting and white coat effects:[21] further evidence is required however the recently published TASMINH4 trial has confirmed the benefits of self-monitoring, with or without telemonitoring, when used by general practitioners to titrate antihypertensive medication in individuals with poorly controlled blood pressure.[103] Further work is need to understand the role of the nurse in receiving, interpreting, and action upon patient measured blood pressure readings.

1.2.2.5 Prescribing

We have previously found greater reductions in blood pressure where interventions include nurse prescribing compared to continued prescribing by doctors, and documented a rising proportion of nurses prescribing in hypertension in our region over time.[18,19] A more recent review of studies substituting prescribing by nurses or pharmacists for prescribing by doctors has also reported overall lower outcome blood pressures, although nurse-led care was not reported separately.[104] On pooled analysis of randomised controlled trials there is a trend towards increasingly greater reductions in systolic but not diastolic blood pressure for interventions that include nurse prescribing (difference in change in systolic blood pressure -6.4mmHg (-9.1 to -3.8); 10 studies, 4285 participants),[32,49,53,59,60,67,71,74,78,105] compared to nurses advising changes to medication (-4.4mmHg (-6.2 to -2.6); 8 studies, 2522 participants)[25,29,51,56,61,73,77,82] or no nursing intervention for medication (-3.2mmHg (-5.3 to -1.2); 32 studies, 9522 participants).[26,28,30,31,33-37,39,40,44-48,50,52,54,58,62,64,66,68,72,73,75,80,81,83-85]

1.2.2.6 Frequency of and intensity of intervention

There is marked variation in the frequency of face to face reviews of patients between trials, with greater reductions of systolic blood pressure for interventions that involve at least monthly contact until blood pressure reaches target (systolic reduction -7.2mmHg (-10.5 to -3.9); 19 studies, 3760 participants)[29,37,46,47,54,55,58,59,61,64,68,72,74,77,80,81,83,84] compared to less frequent interventions (-2.8mmHg (-3.8 to -1.8); 32 studies, 12523 participants; p=0.01).[25,26,28,30-36,39,40,44-54,56,60,62,67,73,75,78,82,85] study blood pressure targets are also more frequently attained, compared to usual care, when interventions are delivered at least monthly (RR 1.5 (1.2 to 2.0); 12 studies, 2915 participants)[14,29,47,55,59,61,64,66,70,72,74,77] compared to less frequently (1.1 (1.0 to 1.2); 21 studies, 15011 participants; p=0.02).[15,25,26,32,34-36,38,41,43,45,47,51,60,63,65,67,73,75,76,78]

By taking account of the interaction between the presence or absence of, and the frequency of, face to face to face interventions and the ability to change prescriptions, it is possible to demonstrate a hierarchy of effectiveness for nurse led interventions to lower blood pressure (fig 1; p<0.001 for subgroup differences). Interventions without face to face contact, themselves ineffective on pooled analysis, are enhanced by the ability to alter medications. The same is found for low frequency (less than monthly) face to face interventions, however greatest differences in blood pressure reductions for nurse led interventions compared to usual care are observed when face to face review occurs at least

monthly. Interestingly, at this level of intervention there seems to be no significant additional benefit in altering medications (systolic mean difference -8.6mmHg (-14.3 to -2.9) without medication change vs. -8.4mmHg (-13.0 to -3.7) with medication changes; p=0.95 for differences), suggesting that frequent face to face reviews may be the most effective element of these interventions.

We have found that frequent nurse led dose titration to achieve rapid control of blood pressure is both safe and feasible.[106] A recent large retrospective study found that delays of greater than 1.4 months before intensifying treatment towards target were associated with higher risks of cardiovascular event or death over 10 years, hinting at the possibility that intensive interventions to control blood pressure quickly may have longer term benefits for outcomes.[107]

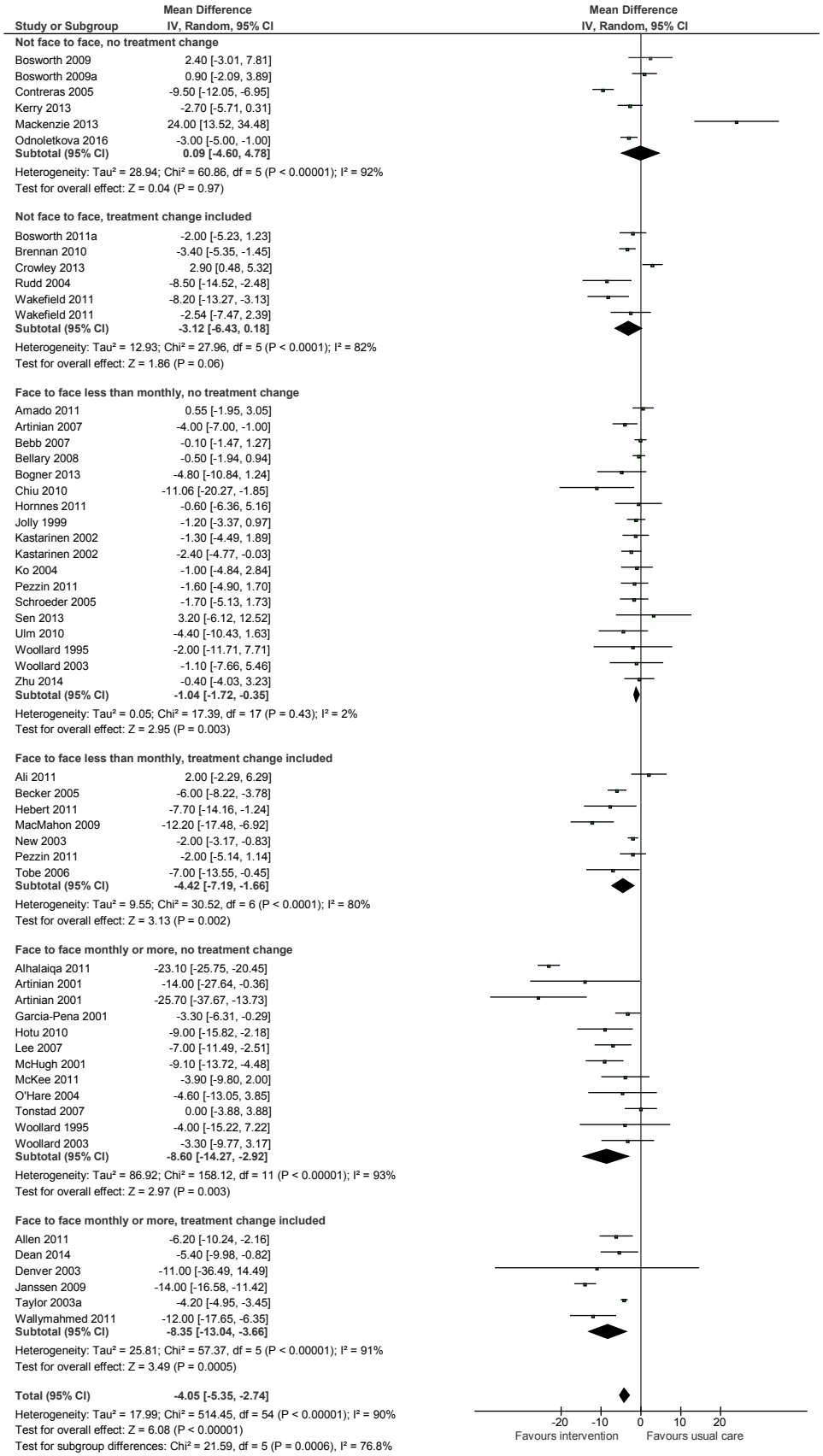

Figure 1. Changes in systolic blood pressure for nurse led interventions compared to usual care grouped by intensity of intervention.

1.3 Costs and cost effectiveness of interventions

Costs of nurse led interventions are infrequently reported as primary outcome measures. Costs will be dependent on the health care system in which the interventions are based, however data were only identified from trials in the UK,[44,75] USA[35,55,73,77,108] and one group in Canada.[69,70] With one exception, a trial of workplace based nurse interventions,[69] costs are higher for nurse led care compared to usual (doctor led) care. Excess costs per patient per year ranged from $212 to $1153 per patient per year, representing between 1.18 and 1.87 times the costs of usual care. There is no clear association between the costs of interventions and either their intensity or their efficacy in reducing blood pressure. Therefore it is difficult to estimate the cost effectiveness of nurse led interventions. One UK trial reported an incremental cost effectiveness ratio per quality adjusted life year of £28.983;[75] this exceeds the £20,000 implementation cost threshold set by the UK National Institute for Health and Care Excellence.[109]

1.4 Clinical implications

The findings of individual trials and systematic reviews summarised here offer some guidance for the design of a successful nurse led programme for care in hypertension. Contacts should be face to face, occurring at least monthly until blood pressure reaches target. They should include the ability to either prescribe, or advise the doctor to prescribe, changes in blood pressure lowering medications and be guided by a structured stepped care algorithm. Lowering of systolic blood pressure by 5mmHg has been estimated to lead to 14% fewer deaths from stroke, 9% fewer deaths from CHD, and 7% fewer deaths overall.[110] These levels of reduction are exceeded by the most intensive nurse led interventions so are clinically as well as statistically important.

There are clinical reasons to favour rapid and effective control of blood pressure; arterial stiffness, a marker of target organ damage, improves in newly diagnosed and treated hypertensives according to the intensity of BP lowering achieved.[111] Similarly post hoc findings from the VALUE trial found that blood pressure response within one month of treatment predicted a persistent advantage for the combined outcome of cardiac events, stroke or death,[112,113] and post hoc analysis of the Syst-Eur trial provided additional evidence for improved outcomes in cardiovascular event reduction for initial dual rather than monotherapy, in association with greater blood pressure reduction.[114] The FEVER study also suggests superior outcomes for early attainment of blood pressure control in a Chinese population.[115] None of these findings, however, relate directly to nurse led interventions to control blood pressure, and evidence for long term differences in outcome for nurse led care is currently lacking.

Extrapolation of trial findings into day to day practice cannot be assumed. Little is known about the acceptability of substitution of nurse led for doctor led care in hypertension. Exploratory findings in our locality suggest that the concept is broadly acceptable to patients,[116] as is the case for nurse prescribing in diabetes, a condition often associated with hypertension.[117] However despite good trial evidence for improved blood pressure lowering

with nurse prescribing we could not confirm this benefit in a recent analysis of routine primary care data from our region.[19]

1.5 Research implications

In trials (and in practice) nurses often work in conjunction with other members of the primary health care team such as community health workers, health care assistants,[19] pharmacists and doctors.[118] Many trials provide evidence for improved outcomes with pharmacist led care[119] but few have examined a team approach utilising both nurses' and pharmacists' expertise.[120,121] Community health workers or lay workers have sometimes been included in trials of interventions,[56,71] often in low resource settings or with a specific role in link working with specific ethnic groups who may experience barriers to accessing healthcare.[80,81] Studies suggest that teams can facilitate self-management,[122] and a recent survey of routine primary care data in our region has documented the increasing involvement of health care assistants in team approaches to hypertension care with better attainment of the English national Quality and Outcomes Framework blood pressure target.[19,123] Future studies need to examine team based approaches that make best use of existing professionals' and multi-disciplinary teams' skills, thus facilitating adoption into existing care structures; some such studies are underway.[124,125]

The available evidence suggests that future trials should abandon telephone support as a component of any intervention, however internet or other telehealth systems may show benefits.[82,126,127] It is possible that nurses may enhance the benefits of home or tele monitoring but their specific role and contribution requires further study.[101,128]

It seems clear that any prospective study design should be resourced for at least a monthly face to face review until blood pressure control is achieved, and should include the ability o prescribe or alter medication according to a stepped care algorithm. Depending on study setting a careful study design will be required to mitigate the effects of setting (home vs clinic) and personnel (nurse vs doctor vs pharmacist) on white coat effects to minimise bias. Ideally future studies will be designed and powered to measure costs and cost effectiveness of interventions, and measure satisfaction and treatment effects using validated tools.

International blood pressure guideline targets are starting to be cut in response to evidence from SPRINT and other recent studies.[129-132] Currently evidence of greater blood pressure lowering only exists for nurse led care down to, but not below, 130mmHg systolic in the context of comorbidities such as diabetes or secondary prevention of cardiovascular and cerebrovascular disease.[25,49,52,60,61,74,75,82,83] It will be important to test nurse led interventions that aim to cut blood pressure to lower more stringent potential targets in primary prevention, to discover whether the existing evidence can be extrapolated.

The reporting of harms from nurse led intervention studies is negligible. Although such interventions are expected to offer a low risk of adverse events this should be confirmed by robust reporting and inclusion of quality of life and satisfaction scales in future studies. Again the implications of increased adverse events seen in trials aiming to lower blood pressure below 130mmHg will have to be taken into account.[129,133]

1.6 Conclusions

There is good evidence to suggest that nurse led interventions can achieve greater blood pressure reductions and achievement of blood pressure targets than usual care. Reviewing patients at least monthly, and changing medication according to a stepped care protocol are shown to be important elements of such interventions. Inclusion of nurses as members or leaders of teams intervening to control blood pressure should be effective but requires further study. Costs and cost benefits of interventions are poorly described and there are no reports of long term effects of outcomes. The ability of nurse led services to adopt new lower blood pressure targets safely may be assumed but cannot currently be demonstrated. Areas for future research are identified.

Acknowledgments

The analyses presented are based on data collected for our Cochrane review: Allied health professional led interventions for improving control of blood pressure in patients with hypertension (A115). The review has been submitted and publication is anticipated during 2018. I thank my co- authors for their contributions to the review: Lyne Cloutier, Shweta Todkar, Judit Konya, Olivia Clark, Sinead McDonagh, Lindsay Smith, Liam Glynn, Rod Taylor and John Campbell.

Disclosure

Christopher Clark is supported by a National Institute of Health Research (NIHR) Clinical Lectureship award. The views expressed are those of the author and not necessarily those of the NIHR, the NHS or the Department of Health.

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